yellow central fascia, irregularly edged on both sides with purplish, more oblique than that in *B. crassicornis*, Walk., and much narrower on the inner margin than on the costa; space before the hind margin pale clear yellow, with a fine dark line from before the apex round the hind margin, beyond which the fringes again are yellow. Hind wings with only the costa pale, the rest of the wing being dark fuscous; fringe yellowish. Head, face, thorax, and abdomen pinkish cinereous. Underside of abdomen whitish; pectus pale yellow; palpi pale yellow, unspotted; tibiæ all spotted alternately purplish and white.

Expanse of wings 28 millim.

One female, Port Darwin.

[To be continued.]

LX.—*On the Anatomy and Embryology of the* Phalangiidæ. By Victor Faussek *.

My Russian memoir has just appeared, under the title "Studien über die Entwicklungsgeschichte und Anatomie der Afterspinnen (Phalangiidæ)" (Arbeit. Petersb. Naturf. Gesellschaft, Abt. Zoologie, Bd. xxii. Lief. 2 [Arbeit. aus dem zootomisch. Kabinet d. Petersb. Universität]), and in order to render my paper more readily accessible to readers abroad I offer the following *résumé* of the more important results of my investigations, some of which have already been published in two smaller provisional communications †; I shall at the same time refer to the figures which accompany my memoir.

1. My researches were conducted upon the ova of two species of *Phalangium*—*Cerastoma cornutum*, L., and *Opilio parietinus*, Herbst. The ova of these differ from one another in the structure of the chorion and in certain conditions necessary for their development. The ova of *C. cornutum* are of a yellowish colour, which is due to a multitude of yellow granules covering the chorion; in the case of *Opilio parietinus* the chorion possesses no yellow granules and the ova are pure white. The ova of *Cerastoma cornutum*, which

* Translated from the 'Biologisches Centralblatt,' xii. Bd. no. 1 (Jan. 15, 1892), pp. 1–8.

† Biol. Centralbl. viii. 12 (1888); Zool. Anzeiger, no. 353 (1891).

were laid in autumn, at once commenced to develop at the temperature of an ordinary room, and within one and a half to two months the whole cycle of development was completed, and the young animals emerged and throve perfectly well throughout the entire winter. The ova of *Opilio parietinus* perished under the same conditions, and were capable of further development only after passing the winter in a normal state, when I placed them upon the ground. Besides these two species I also had a few ova of larger size belonging to a species which I failed to determine.

2. With regard to reagents, Flemming's mixture gave the best results, in addition to Perenyi's fluid and sometimes (for the earlier stages) hot absolute alcohol. I did not study the formation of the segmentation nuclei. The earliest stages which I examined showed the ovum divided up into a compact mass of cells; in each of the large segments there lay a large nucleus (Taf. i. figs. 6 and 7 of the Russian memoir). The ovum consequently undergoes total segmentation and passes through a morula stage. The first blastoderm (ectoderm) cells split off from the superficially situated blastomeres, as is correctly described by Henking*. The segmentation nuclei do not come to the surface of the ovum, but all remain within the blastomeres. In the Araneidæ, as may be gathered from the investigations of Morin †, total segmentation also takes place and the ova pass through a blastula stage, having a large segmentation cavity. In *Phalangium* a solid morula is formed, and the ectoderm cells are produced by being split off, as it were, by delamination.

3. The entire ovum gradually becomes clothed with a layer of flat ectoderm cells, and thus passes into the bilaminar stage. After the formation of the ectoderm the inner egg-membrane (oolemma) becomes considerably thicker, so that two layers can be distinctly distinguished in it, which, however, are closely apposed to one another and never separate. There is an evident secretion of cuticular substance by the ectoderm cells, which gives rise to the formation of a kind of embryonic membrane; yet this new cuticular membrane does not form an independent envelope, but serves to thicken the oolemma. This subsequent secondary thickening of the *membrana vitellina* by the formation of a new cuticular layer secreted from the ectoderm is comparable to the formation of

* Henking, "Untersuchungen über die Entwicklung der Phalangiden," Zeitschrift f. wiss. Zoologie, 45 Bd.

† Morin, "Ueber die Entwicklung der Spinnen" (in Russian), Zeitschrift der Neurussischen Gesellschaft in Odessa, xiii. Bd. (1888).

that blastodermic membrane which is produced from the blastoderm in many Crustacea (figs. 7 and 11).

4. The germinal disk arises at one pole of the ovum by multiplication of the ectoderm cells. The newly formed lower layer of the primitive streak represents the mesoderm, since the endoderm is differentiated from the beginning. Among the cells of the lower layer a group is separated off from the commencement, the cells of which are distinguished by their size and peculiar appearance. The separation of this group of cells even precedes the formation of the primitive streak; as early as the time when the ectoderm clothes the ovum with a cellular layer this group of cells already projects as a little cluster into the interior of the ovum (figs. 9, 10, 11). This cluster lies, as is subsequently to be seen, in the posterior portion, although not quite at the end, of the ventral streak, and consequently forms a local thickening of the ectoderm, which arises almost simultaneously with the mesoderm, and afterwards furnishes the germ-cells.

5. The nuclei of the large endoderm cells frequently suffered from the effects of the reagents, and then appeared to be destitute of a membrane (fig. 8); but they were well fixed by means of Flemming's fluid, and presented the appearance shown in figs. 7, 9, 11, 12, and 13. The nuclei, which are figured in Henking's paper mentioned above, also seem to me (at least in some cases) to have suffered from the fixative fluids, and therefore to exhibit no membrane and no sharp outlines. That which, for instance, he considers to be several nuclei in one cell (*vide* his fig. 37), I am inclined to regard as being nucleoli of a large nucleus, the membrane of which is destroyed. At the time of the formation of the mesoderm the nuclei of the endoderm become considerably larger, so that in comparison with the cells of the germinal disk they appear quite gigantic. They possess a sharp contour and are very poor in chromatin; almost the whole of the colourable substance of the nucleus is concentrated in a nucleolus, which is very glistening and takes a deep stain. We often meet with figures which seem to point to amitotic nuclear division (fig. 13); it appears that this nuclear division is also followed by division of the cell (fig. 12). At any rate the endoderm cells never become multinuclear, and even cells with two nuclei are rare. I succeeded in determining a similar characteristic nuclear structure in the endoderm (yolk-cells) of the Araneidæ also, in the earlier stages of their development; this had not previously been described by any author (*Tegenaria*, figs. 14 and 15). In Araneidæ and Phalangiidæ there consequently occurs a fragmentation of the

nucleus in Ziegler's * sense; the nuclei, however, do not lose their histogenetic property (see below). The study of the fragmentation of the nuclei has led me to wonder whether it may not be that the so-called "secondary mesoderm" of the Crustacea (*Astacus*, according to Reichenbach) represents no cellular elements, but nuclei in the state of fragmentation.

6. The mesoderm is formed, as has been stated, from the ectoderm; but during the first period of development a few elements of endodermic origin are also added to it; these are large cells which split off from the endoderm cells (figs. 13 and 16). A small number of them separate from the endoderm cells lying peripherally immediately beneath the primitive streak, and are soon indistinguishable from the cells of the latter; for this reason I was unable to ascertain their subsequent fate.

7. It has already been mentioned that the rudiment of the germ-cells appears in the ectoderm at a very early period and projects into the interior of the ovum. In the earliest stages differences in the germinal rudiment may already be perceived in certain ova. In some cases the rudiment consists of cells with large nuclei, but in others their nuclei do not differ much from those of the cells of the primitive streak. The first stage in the further development of the rudiment of the sexual organs consists in its separation from the ectoderm; its cells become superficially covered by a layer of ordinary ectoderm cells (fig. 17). In somewhat later stages the rudiment of the sexual organs lies sunk in the abdominal nervous system (figs. 18 and 19); after the nervous system withdraws into the cephalothorax, however, the germinal rudiment remains in the abdomen behind the cephalothoracic ganglia, where it now appears between two layers of mesoderm, *i. e.* enclosed in the cœlom (figs. 19, 20, and 21). In subsequent stages the germinal rudiment with the large nuclei considerably increases in size, and after the emergence of the embryo serves to form the female generative organs (figs. 20, 22, 23, 27, 28, and 29). The germinal rudiment of the second kind (that which consists of cells with small nuclei) remains of inconsiderable size and becomes transformed into the male gene-

* Ziegler, "Die Entstehung des Blutes bei Knochenfischembryonen," Archiv f. mikrosk. Anatomie, 30 Bd. While my memoir was in the press there appeared the interesting papers of Ziegler on "Die biologische Bedeutung der amitotischen (direkten) Kernteilung im Tierreich," Biologisches Centralblatt, xi. Bd. nos. 12 and 13 [Ann. & Mag. Nat. Hist. ser. 6, vol. viii. Nov. 1891, "The Biological Import of Amitotic (Direct) Nuclear Division in the Animal Kingdom," pp. 362–380], and Frenzel, "Zur Beurteilung der amitotischen (direkten) Kernteilung," *ibid.* no. 18, of which I was unable to avail myself.

rative organs (figs. 24, 25, and 26). During the first two months of post-embryonic life the further development of the female germinal rudiment and the transformation of the embryonic germ-cells into egg-cells can be easily traced in young Phalangiidæ (figs. 27 and 28). I did not succeed in investigating the final development of the male germinal rudiment; in young harvest-men the latter appeared as a tolerably small group of cells lying in the abdomen immediately behind the nervous system, and, like the female rudiment, separated from the latter and from the body-wall by a layer of loose connective tissue (figs. 25 and 26). In size the male rudiment is far inferior to the female during the same period of development. These embryonic germinal rudiments form in the first place the commencement of the actual germ-glands, *i. e.* ovary or testis as the case may be; other portions of the reproductive organs, male as well as female, are completely wanting at the time when the young emerge, and their formation devolves entirely upon the post-embryonic development. The female as well as the male germinal rudiments are enveloped in an extremely delicate *membrana propria* containing very small scattered nuclei. In *Phalangium* therefore there takes place a very early separation of the germ-cells, similar to what we find in *Moina*, *Chironomus*, and the Aphidæ.

8. The endoderm cells preserve their general form and structure without any changes worthy of remark until the later stages of development; they merely become somewhat smaller. But the fragmentation of the nuclei continues for only a limited period. When the nervous system begins to develop the nuclei of the endoderm cells have already lost the characteristic signs of fragmentation; they have now become smaller and no longer possess their former peculiar structure. The definitive formation of the mesenteron takes place quite at the end of the embryonic development, after the external form of the embryo is already complete, the nervous system concentrated in the cephalothorax, and the portions of the alimentary canal which are derived from the ectoderm (stomodæum and proctodæum) are fully developed. The visceral layer of the mesoderm forms folds, which penetrate deep into the yolk and divide it into separate masses (the subsequent hepatic sacs). The central portion of the yolk remains undivided and forms the actual mesenteron. At the close of the embryonic development the endoderm cells appear to undergo a process of degeneration; they lose their contour and the yolk-spherules lie at liberty; in some cases small roundish nuclei, which are sometimes amœboid

and sometimes larger, are found between them. At the periphery of the yolk, where the splanchnic layer of the mesoderm adjoins it, there appears (even before its division into the future hepatic sacs) a number of small cells with small round nuclei; these cells, which in all probability split off from the large endoderm cells, settle down upon the visceral layer of the mesoderm and form the epithelium of the mesenteron. Thus it is not the endoderm cells themselves but their derivatives which give rise to the epithelium of the mid-gut (figs. 31 and 32).

9. The coxal glands of an adult harvest-man consist of three divisions:—(1) the inner end is expanded in the form of a sac, and constitutes the terminal vesicle; (2) the terminal vesicle narrows and passes into a very long convoluted tube, the tube of the coxal gland, which has long been known (Malpighian vessel); (3) the tube empties itself into a large thin-walled sac (urinary bladder), which opens to the exterior at the side in the cephalothorax, between the coxæ of the third and fourth pairs of legs. The terminal vesicle of the coxal gland has hitherto never been described. It is situated in the cephalothorax as an elongated saccule, at the side of the ganglionic mass surrounding the œsophagus, at the base of the third pair of legs; at the anterior end the saccule bends downwards and somewhat inwards, runs a little way backwards, and terminates blindly near, and on the inside of, the external opening of the coxal gland (fig. 50, es'). In transverse sections we therefore see two lumina, one above the other (fig. 23, es^2, es^1); but on scrutinizing a series of sections we can easily convince ourselves that both lumina pass into one another anteriorly, while posteriorly the lower saccule (the doubled-down anterior end of the terminal vesicle) ends blindly and the upper one becomes narrower and passes into the tube (fig. 50, es^1, es^2, cox^2; fig. 34, es^2; fig. 35, cox^2). This tube, at first excessively thin (figs. 50 and 35, cox^2), becomes gradually wider, and passes into the long-known convoluted tube, the "Malpighian vessel" of Plateau, the true significance of which was first recognized by Loman *. The tube of the coxal gland forms a complicated coil, passes towards the dorsal side of the body, where it makes a loop running parallel with the heart, then returns

* Plateau, "Sur les phénomènes de la digestion, etc. chez les Phalangides," Bull. Acad. Belg. 1876; Rössler, "Beiträge zur Anatomie der Phalangiden," Zeitschr. f. wiss. Zool. Bd. 34. 1882; Loman, "Altes und Neues uber das Nephridium (die Coxaldrüse) der Arachniden," Bijdr. tot de Dierkde. N. A. M. 14 Aufl., 1888. The recent paper by Sturany ("Die Coxaldrüsen der Arachnoiden," Arch. Zool. Instit. Wien. 9 Bd., 1891) came into my hands after my memoir was quite finished.

towards the ventral surface, and opens into the urinary sac (figs. 34, 35, and 50, *cox*, *cox*[1]). The latter (figs. 33, 34, 35, and 50—*HS*, *O. HS*) extends a long way backwards into the abdomen, while in front it stretches beyond the point of attachment of the third pair of legs; with its anterior blind end it closely adjoins the bow-shaped bend of the terminal vesicle (fig. 50). Not far from its anterior end there issues from the urinary sac a tolerably narrow duct, which passes downwards and opens to the exterior between the coxæ of the third and fourth pairs of legs (Loman) (figs. 33, 50—*O. HS*). It was impossible to examine the histological structure of the terminal vesicle more closely, since this portion of the gland was found to be in a rather bad state of preservation in the preparations. The structure of the tube (figs. 37, 38) did not exhibit any considerable deviations from the typical structure of coxal glands, as, for instance, it has been described by Lankester and others in *Scorpio*, &c. The wall of the urinary sac (fig. 36, surface view) consists of a *membrana propria* with small and a pavement epithelium with large nuclei; muscle-fibres were not found in it. The remainder of the chapter on the coxal glands is devoted to an analysis of the papers upon the coxal glands of the Arachnids, especially to a criticism of the views of Eisig *, according to which the coxal glands are homologous not with the nephridia, but with the setæ-forming glands (" Borstendrüsen ") of the Annelids. I may sum up my own views as follows:—(*a*) the coxal glands of *Phalangium* consist of three divisions—terminal vesicle, tube, and urinary sac; (*b*) the same divisions are found in the antennary glands of the Crustacea †; (*c*) these three divisions are homologous with the three portions of the nephridium of *Peripatus* (and Annelids), with the funnel and terminal vesicle (in *Peripatus*—in Annelids the adjoining portion of the cœlome), the tube, and the expansion of the latter at its distal end; (*d*) the coxal glands of *Limulus* and Arachnids, as well as the excretory organ of the *Zoëa* of *Eryphia* described by Lebedinski ‡, and the antennary and shell-glands of the Crustacea are homologous with the nephridia of *Peripatus* and Annelids; (*e*) Eisig's hypothesis as to the homology of the coxal glands of the Arachnids with the

* Eisig, "Die Capitelliden," Fauna und Flora des Golfes von Neapel, xvi. Monographie, 1887, i. p. 374 *et seq.*

† The "nephro-peritoneal sac" of the Decapods according to Weldon (Weldon, "The Renal Organs of certain Decapod Crustacea," Quart. Journ. Micr. Sci. 1891, vol. xxxii.) probably corresponds to an extraordinarily developed urinary sac.

‡ Lebedinski, "Entwicklung von *Eryphia spinifrons*," Zeitschrift der Neurussischen Naturf. Ges. in Odessa, Bd. xvi., 1889 (in Russian).

spinning-glands of *Peripatus* and the setæ-forming glands of the Annelids proves to be untenable.

10. The cephalothoracic glands described by Krohn are constituted in the final stages of development as two pyriform invaginations of the ectoderm at the side of the two eyes (figs. 40, 41, and 47, *c. dr.*). In the ectoderm cells of the glands there commences at an early period the secretion and accumulation of a dark pigment which forms two black spots upon the surface of the embryo, which is still perfectly white; these spots are visible like the eyes through the egg-membranes. Simultaneously with the glandular structures which have been described there exists in the embryo a pair of provisional organs of a glandular character. In *Cerastoma cornutum* these appear as two groups of large cells, lying one on each side in the cephalothorax near the eyes. Externally these cells are directly covered by the ectoderm, and they appear to be separated from the body-cavity by a thin *membrana propria.* In addition to a large nucleus the cells of this organ enclose peculiar concretions, which take a deep stain from carmine. Although covered by the ectoderm these cells nevertheless possess a communication with the outer world by means of a special aperture, through which the concretions which are formed in them are conveyed to the exterior. In the sections a compact mass of these excretions generally lies at this aperture (figs. 39, 40, 41, 44, and 45). In another undetermined species of *Phalangium* the glandular structure of this organ was even more pronounced. In this case it consisted of a tolerably large hemispherical complex of cells, which projected freely into the body-cavity and was attached to the ectoderm by a relatively smaller portion (figs. 42, 43, 46, and 47); the apices of the columnar and distinctly defined pyramidal cells of this organ met together in a point, while their broad bases formed a hemispherical surface. In each cell a large nucleus was situated not far from the base, while the excretory products were accumulated nearer the apex. The external aperture of the gland had the form of a small pit, filled with secretion deeply stained by carmine; short rods of this secretion radiated from this pit between the apices of the cells (fig. 43). But these glands had not exactly the same structure in all preparations of this species of *Phalangium*; in some cases they were suggestive of those of *Cerastoma cornutum* (fig. 48). At the same time the embryos investigated were all at the same stage of development. I have consequently found in two species of *Phalangium* during embryonic development a peculiar glandular organ, which lies in a single pair in the cephalothorax,

between the eyes and the cephalothoracic glands on each side, and probably has an excretory function. In the two species examined this organ exhibited considerable differences in structure. The organs are purely embryonic; in the youngest specimens of harvest-men which I was able to examine I no longer found any trace of them. I failed to elucidate their fate during the transition to post-embryonic life. This pair of glands reminded me forcibly of the dorsal organ of the Mysidæ, as recently described by Nussbaum * and Butschinski †. Although I did not succeed in observing its first appearance, I nevertheless consider it to be very probable that it appears, precisely like that of *Mysis* (at least in the case of the second species of *Phalangium*), in the form of an invagination of the ectoderm. Similar organs have been observed by Watase ‡ in *Limulus*, where they were also found to resemble the dorsal organs of *Mysis*. Kingsley and Patten, however, consider these organs in *Limulus* to be of a sensory character §. As regards *Phalangium* the glandular character of "the lateral or dorsal organs" cannot be open to the slightest doubt, as is proved by the numerous concretions enclosed in their cells and their excretion to the exterior.

LXI.—*Description of a Third Species of the Genus* Nyctophilus. By OLDFIELD THOMAS.

THE genus *Nyctophilus* was in Dr. Dobson's 'Catalogue of Bats' ‖ considered to consist in 1878 of only a single species, the Australian Long-eared Bat, *Nyctophilus timoriensis*, a species with very much the facies, and evidently taking the place in Australia, of the European Long-eared Bat, *Plecotus auritus*. In 1888 ¶ I had the pleasure of describing a second species of the genus from New Guinea, *N. microtis*, which

* Nussbaum, "Zur Embryologie von *Mysis chamæleo*," Zeitschr. Neuruss. Naturf. Gesellschaft in Odessa, xii. Bd., 1887.

† Butschinski, "Zur Entwicklungsgeschichte der Mysiden," Zeitschr. Neuruss. Naturf. Gesellschaft in Odessa, xv. Bd., 1890.

‡ Watase, "On the Structure and Development of the Eyes of *Limulus*," Johns Hopkins Univ. Circ. vol. viii.

§ Kingsley, "The Ontogeny of *Limulus*," Zool. Anz. 1890; Patten, "On the Origin of Vertebrates from Arachnids," Quart. Journ. Micr. Sci. xxxii., 1890.

‖ P. 172.

¶ Ann. & Mag. Nat. Hist. (6) ii. p. 226.